Barrier at Bridge Approaches

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Barrier is used on bridge approaches to prevent vehicles from colliding with bridge endposts or with secondary obstacles under or near the bridge (such as steep embankments, sign-truss footings, rivers, railroads, and other roadways). All bridges on the primary road system should be evaluated using criteria from this section to determine if barrier is warranted. Bridges on secondary roads must meet the same criteria if they are part of an interchange or an overhead separation. Other secondary road bridges that are involved in a project should have barrier installed that conforms with current requirements of the Office of Local Systems.

Warrants – Rural Bridges

Approach Side Bridge Endposts

Approach side bridge endposts are always shielded. Designers should also check for secondary obstacles located within the clear zone that may warrant extending an approach barrier. For more information on the clear-zone concept, see Section 1C-2 of this manual and Chapter 3 of the AASHTO *Roadside Design Guide*.

Trailing Side Bridge Endposts

Two-way Bridges. All four bridge endposts are shielded on two-lane two-way bridges. For multilane two-way bridges, or bridges that carry a two-lane road with a median, trailing side bridge endposts are shielded if located in the clear zone for opposing traffic. If the trailing side bridge endpost is located outside of the clear zone, the designer will want to carefully examine how far outside of the clear zone the endpost is located, in combination with factors such as anticipated traffic volumes or running speeds, to determine if the endpost should be shielded.

Dual or One-way Bridges. Trailing lengths of guardrail are not normally installed on the outside of dual bridges unless secondary obstacles warrant them. Median width determines if median side bridge endposts will have guardrail attached. For median widths of more than 50 feet (15 meters), median side bridge endposts will normally not require guardrail to be attached. Median widths of 50 feet (15 meters) or less require a special design. Contact the Methods Section in the Office of Design for assistance.

Warrants – Urban Bridges

For bridges on urban roadways, posted speed determines if a bridge endpost is shielded with guardrail or if a sloped concrete end treatment (Standard Road Plan RE-46) is used.

- If the posted speed is 45 mph or greater, use guardrail or an attenuator.
- If the posted speed is 40 mph or less, use a sloped concrete end treatment.
- If site conditions do not allow for guardrail, an attenuator, or a sloped concrete end treatment, contact the Methods Section in the Office of Design.

Other barrier installations in urban areas should be justified on an individual basis.

Guardrail Design at Bridge Endposts

For most situations, formed steel beam guardrail is used to shield bridge endposts. The same graphical procedure discussed in Section 8B-1 to lay out guardrail for shielding side obstacles is used for bridge endposts and secondary obstacles. For all approach side bridge endposts, guardrail length sufficient to protect out to the clear zone is required. For two-way bridges, trailing side bridge endposts are protected if in the clear zone and guardrail length should be sufficient to protect to the clear zone. Clear zone for the trailing side is measured from the center of the roadway, not the edge of traveled way, see Figure 1. For one-way bridges, guardrail length for both bridge endposts should be sufficient to protect out to the clear zone. Clear zone is measured from the edge of traveled way for both inside and outside lanes, see Figure 1.

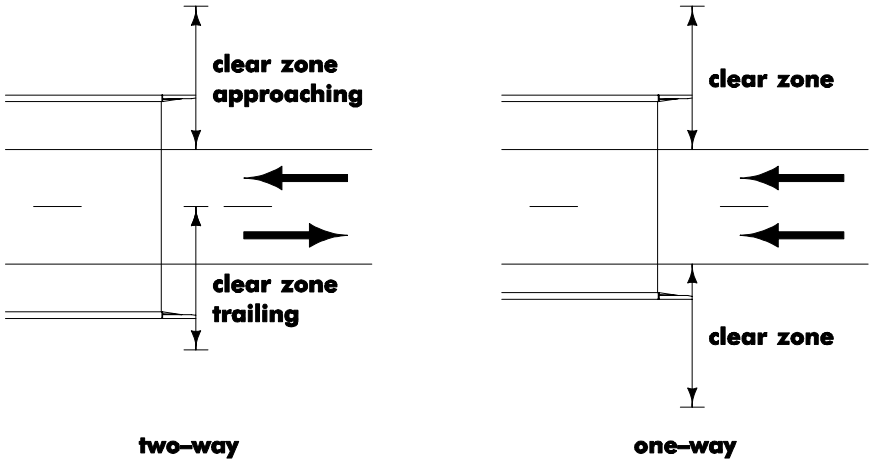

Figure 1: Measuring clear zones at bridge approaches.

To determine guardrail length, first determine the clear zone. Section 1C-2 discusses the clear zone. Once the clear zone has been determined, use the runout lengths provided in Table 2 of Section 8B-1 to lay out a triangle similar to that shown in Figure 2 of Section 8B-1. From this, the appropriate guardrail length is determined.

With 3R projects designers will often encounter foreslopes that are 4:1 or steeper. The clear zone for areas such as these is not clearly defined, and sound engineering judgment is required to determine how far out to protect. However, once the engineer has determined how for out to protect, the same procedure is used for laying out the triangle used to determine guardrail length.

Preferably, the face of the guardrail should be located twelve feet (3.6 meters) from the edge of traveled way. High fill and steep foreslopes may limit how far from the traveled way the face of the guardrail can be placed. In situations such as these, enough VF should be used to get the installation a minimum of two feet (0.6 meters) off of the shoulder if feasible; otherwise, the guardrail may be placed at the edge of the shoulder. This will often require a combination of variable tangent (VT) and variable flare (VF) similar to that shown in Figure 2. Installations requiring a combination of VF and VT will be very common where bridge shoulder widths are less than roadway shoulder widths.

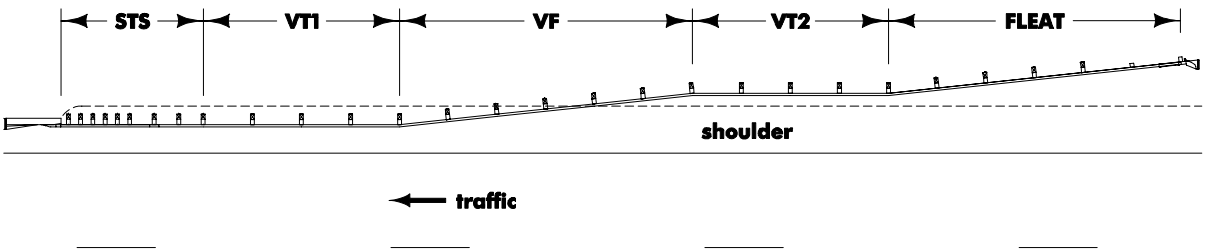

Figure 2: Guardrail installation with a combination of VT and VF.

Sample Guardrail Installations at Bridge Endposts

Several examples of guardrail installations at bridge endposts are provided. The same graphical procedure used in Section 8B-1 for determining guardrail length is used for all of the examples below. Designers should note that these are examples, not templates. Site conditions will determine the best combination of VT and VF to use to minimize installation costs.

Two-way full shoulder width bridge.

Design year ADT = 4500.
Design speed = 60 mph.
44-foot wide bridge.
10-foot roadway shoulders.
6:1 foreslopes.
Clear zone = 30 feet.
Runout Length = 180 feet.

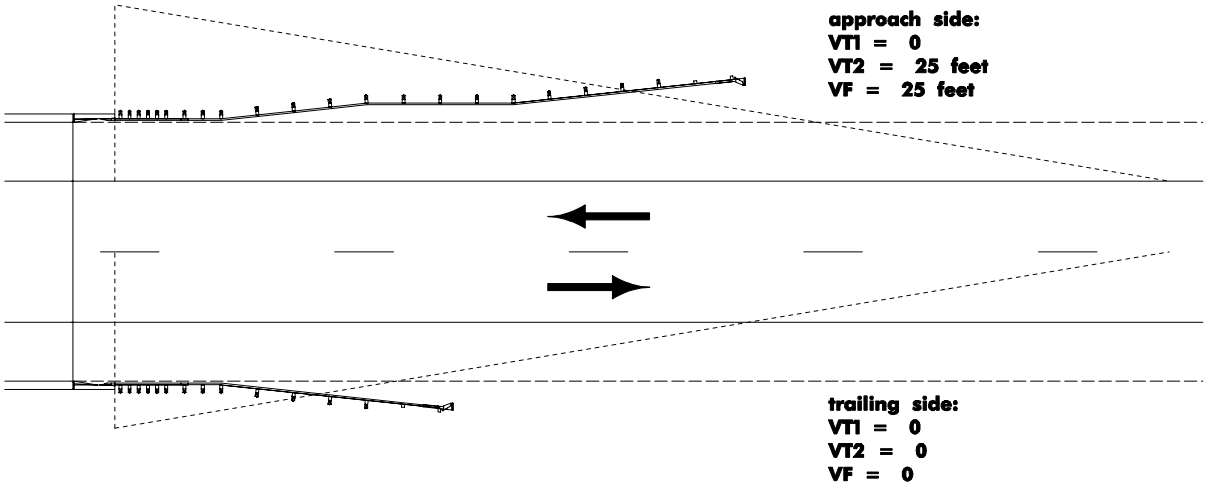

Figure 3: Two-way full shoulder width bridge.

Two-way bridge with narrow shoulders.

Design year ADT = 3360.
Posted speed = 55 mph.
30-foot wide bridge.
6-foot roadway shoulders.
Decision was made to protect out to 24 feet.
Runout Length = 180 feet.

2.5:1 foreslopes in high fill area. Because of steep foreslopes and high fill, guardrail is placed at the edge of the shoulder rather than 12 feet from edge of traveled way. Sod flumes were chosen. Variable tangent is carried through the sod flumes.

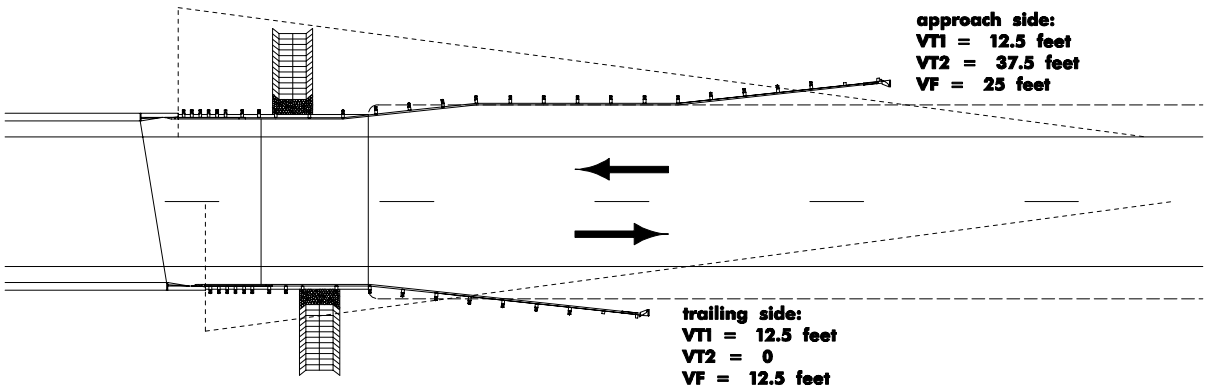

Figure 4: Two-way bridge with narrow shoulders.

Dual bridges with median less than 50 feet (15 meters)

Design year ADT = 16500.
Design speed = 70 mph.
30-foot wide bridge.
10-foot outside shoulders.
6-foot median shoulders.
3:1 outside foreslopes.
Median = 40 feet.
Clear zone = 34 feet.
Runout Length = 360 feet.

Because of the narrow median, a special design using a Median FLEAT is used. This is just one option. Others are available and designers should contact the Methods Section in the Office of Design when faced with similar situations.

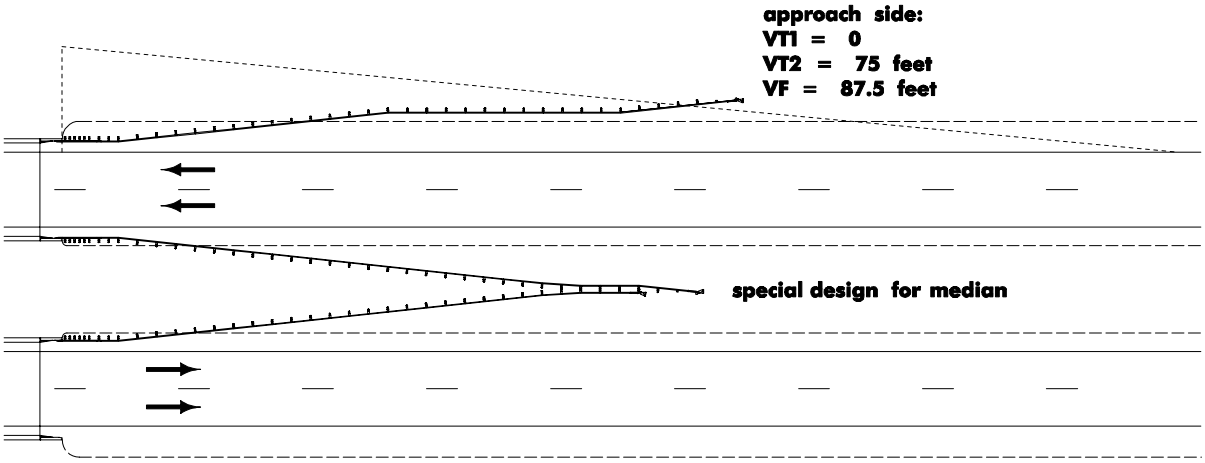

Figure 5: Dual bridges with median less than 50 feet.

Dual bridges with median greater than 50 feet (15 meters)

Design year ADT = 9000.
Design speed = 70 mph.
40-foot wide bridge.
10-foot outside shoulders.
6-foot median shoulders.
6:1 foreslopes.
Median = 64 feet.
Clear zone = 34 feet.
Runout Length = 300 feet.

Because of the wide median and flat foreslopes, the face of the guardrail is placed 12 feet from the edge of traveled way for both lanes.

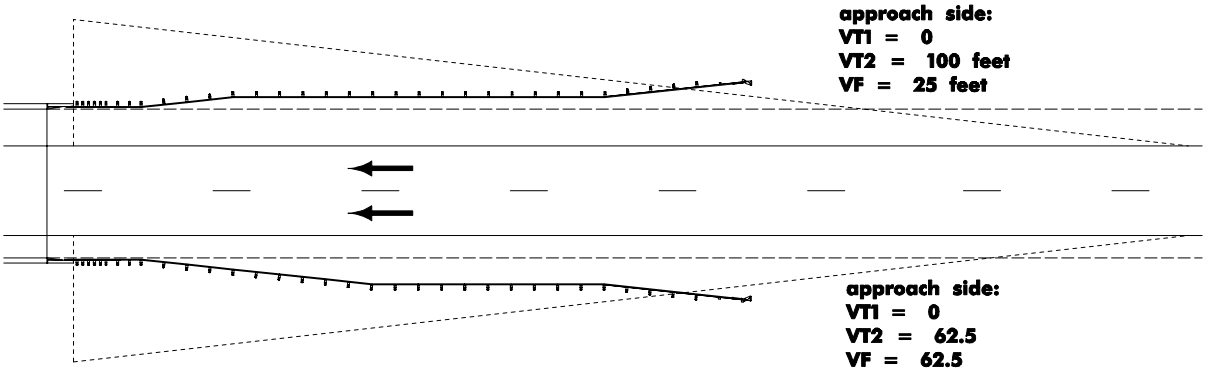

Figure 6: Dual bridges with median greater than 50 feet or one-way bridge.

Two-way bridge with steep foreslopes and secondary obstacles

Design year ADT = 3700.
Posted speed = 55 mph.
30-foot wide bridge.
6-foot roadway shoulders.
2:1 foreslopes
Runout Length = 180 feet.

High fill areas where trees are located. Intakes are used for bridge end drains. The trees are located at the toes of the foreslopes. The decision was made to protect out to the trees since they are at the bottom of non-recoverable forslopes. Because of steep foreslopes and high fill, guardrail is placed at the edge of the shoulder. In addition, a 2.5-foot offset, rather than a 4-foot offset, was used with the FLEAT.

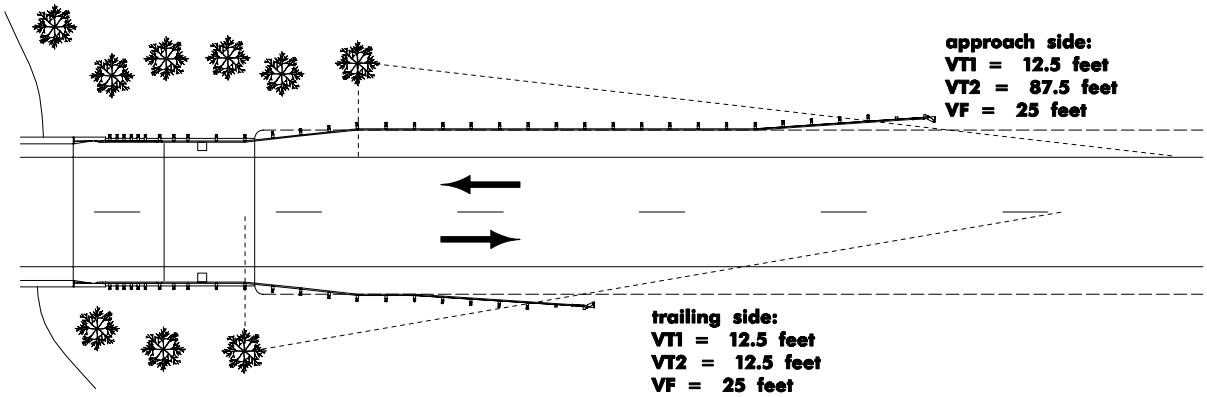

Figure 7: Two-way bridge with secondary obstacles.

Special Situations

Designers occasionally run into situations when site conditions do not allow for a formed steel beam guardrail installation. A common example is a side road located close to a bridge. For situations such as these, contact the Methods Section in the Office of Design for assistance.

Connections to Bridge Endposts

Connections of guardrail systems to bridge endposts vary depending on the type of bridge endpost. RE-69A is used for connections to current non-flared bridge endposts and RE-69B is used for connections to non-flared retrofit bridge endposts. RE-69C is used for connections to existing flared bridge endposts. RE-27B may be used in special situations when connecting to non-standard bridge endposts.

Note that the w-beam system uses a Standard Transition Section (Standard Road Plan RE-68) before attaching to the bridge endpost. On old bridges where the decision has been made to not retrofit the bridge rail, a special design will be required. Contact the Methods Section for assistance.